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Indian Standard
SPECIFICATION FOR
STEELS FOR PISTON PINS
(GUDGEON PINS)

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Indian Standard

SPECIFICATION FOR STEELS FOR PISTON PINS (GUDGEON PINS)

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Indian Standard

SPECIFICATION FOR STEELS FOR PISTON PINS (GUDGEON PINS)

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 5 May 1986, after the draft finalized by the Co-ordinating Committee on Materials for Automobiles had been approved by the Structural and Metals Division Council.

0.2 Piston pin forms a very important component of the internal combustion engine. In order to regulate the quality of steel used for manufacture of piston pins, it has been felt necessary to bring out this standard.

0.3 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard covers the requirements of chemical composition and mechanical properties of steels used for the manufacture of piston pins.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in the relevant parts of IS : 1956† shall apply.

3. MANUFACTURE

3.1 The steel shall be manufactured by primary process (electric arc furnace or LD or any other process) and followed by one of the refining processes such as argon rinsing, vacuum treatment, electro flux refining or 'synthetic slag refining. The continuously cast material can be supplied with mutual agreement only.

*Rules for rounding off numerical values (*revised*).

†Glossary of terms relating to iron and steel (issued in parts).

4. CHEMICAL COMPOSITION

4.1 When analyzed in accordance with the procedure given in IS : 228* and its relevant parts, chemical composition of steels shall conform to that given in Table 1.

TABLE 1 CHEMICAL COMPOSITION OF STEELS FOR THE MANUFACTURE OF PISTON PINS

(Clauses 4.1 and 4.2)

GRADE DESIGNATION [IS : 1762 (Part 1) - 1974*]	CHEMICAL COMPOSITION, PERCENT								
	C	Si	Mn	S	P	Cr	Ni	Mo	B
C15	0.12	0.15	0.30	0.035	0.035	—	—	—	—
	0.18	0.35	0.60	Max	Max				
15Cr3	0.12	0.15	0.40	0.035	0.035	0.4	—	—	—
	0.18	0.40	0.60	Max	Max	0.7			
15Cr6Ni6	0.12	0.15	0.40	0.035	0.035	1.4	1.4	—	—
	0.17	0.40	0.60	Max	Max	1.7	1.7		
16Mn5Cr4	0.14	0.15	1.00	0.035	0.035	0.8	—	—	—
	0.18	0.40	1.30	Max	Max	1.10			
14Mn4	0.10	0.05	0.60	0.070	0.050	—	—	—	—
	0.18	0.35	1.00	Max	Max				
18Cr3	0.16	0.10	0.60	0.050	0.050	0.60	—	—	—
	0.21	0.35	0.80	Max	Max	0.80			
15Ni13Cr3Mo2	0.12	0.10	0.30	0.050	0.050	0.60	3.00	0.10	—
	0.18	0.35	0.60	Max	Max	1.10	3.75	0.25	
15Ni5Cr4Mo1	0.20	0.35	0.50	0.050	0.050	0.75	1.00	0.08	—
	Max	Max	1.00	Max	Max	1.25	1.50	0.15	
15Cr4	0.10	0.15	0.55	0.03	0.03	0.85	—	—	—
	0.18	0.35	0.90			1.25			
15Cr4Mo3	0.12	0.15	0.55	0.03	0.03	0.85	—	0.15	—
	0.18	0.35	0.90			1.25		0.35	
20Ni2Cr2Mo2	0.18	0.20	0.70	0.035	0.035	0.40	0.40	0.15	—
	0.23	0.35	0.90	Max	Max	0.60	0.70	0.25	
15C4-BT†	0.12	0.05	0.50	0.050	0.050	—	—	—	0.003
	0.18	0.40	1.00	Max	Max				

NOTE — Micro alloying elements like Nb, V, Ti can be added to the above steels with prior consent of purchaser provided the total content of these elements does not exceed 0.2 percent.

*Code for designation of steels: Part 1 Based on letter symbols (first revision).

†Suffix BT indicates Boron Treated Steel.

*Methods for chemical analysis of steels (in parts).

4.2 Check Analysis — The permissible variation from the limits specified in Table 1 shall be as given in Table 2.

TABLE 2 PERMISSIBLE VARIATION IN CHECK ANALYSIS

ELEMENT	PERMISSIBLE CONTENT IN CAST ANALYSIS	PERMISSIBLE DEVIATION IN PRODUCT ANALYSIS
(1)	(2)	(3)
	Percent	Percent
C	≤ 0.25	± 0.02
Si	≤ 0.40	± 0.03
Mn	≤ 1.00	± 0.04
If Mn > 1.00 but	≤ 1.30	± 0.05
P	≤ 0.06	± 0.005
S	≤ 0.05	± 0.005
Cr	≤ 2.00	± 0.05
Ni	≤ 1.00	± 0.03
If Ni > 1.00 but	≤ 2.00	± 0.05
If Ni > 2.00 but	≤ 5.00	± 0.07
Mo	≤ 0.60	± 0.03
B	≤ 0.005	—

NOTE — ± means that in one cast the deviation may occur over the upper value or under the lower value of the specified range in Table 1 but not both at the same time.

4.3 Residual Elements — Elements not specified in Table 1 shall not be added to the steel, except where agreed to, other than for the purpose of finishing the heat, and shall not exceed the following limits:

<i>Constituents</i>	<i>Percent</i>
Chromium	0.20
Nickel	0.25
Molybdenum	0.05
Copper	0.20
Vanadium	0.05

5. MECHANICAL PROPERTIES

5.1 The mechanical properties in the heat-treated condition shall conform to those given in Table 3.

5.2 The hardness of the steel when measured in accordance with IS : 1500-1983* shall not exceed the limits given in Table 3. The hardness shall be uniform throughout the section of the bars and also from bar to bar in any given batch.

TABLE 3 MECHANICAL PROPERTIES OF STEELS FOR PISTON PINS IN THE REFINED AND QUENCHED CONDITION
(*Clauses 5.1 and 5.2*)

GRADE DESIGNATION [IS : 1762 (PART 1)-1974*]	RULING SECTION, DIA (mm)	TENSILE STRENGTH (MPa)	HARDNESS (ANNEALED CONDITION) BHN <i>Max</i>
C15	11	740-880	146
	30	590-780	
15Cr3	11	780-1 030	126-174
	30	690/880	
15Cr6Ni6	11	960-1 270	170-217
	30	880-1 180	
16Mn5Cr4	11	880/1 180	156-207
	30	780-1 080	
14Mn4	11	735/885	146
	30	590-785	
18Cr3	11	785-1 030	190
	30	685-885	
15Ni13Cr3Mo2	11	1 180 <i>Min</i>	230
	30	1 000 <i>Min</i>	
15Ni5Cr4Mo1	11	1 150 <i>Min</i>	230
	30	1 000 <i>Min</i>	
15Cr4	11	840 <i>Min</i>	185
15Cr4Mo3	11	880-1 180	195
20Ni2Cr2Mo2	11	980-1 270	217
15C4-BT†	11	750 <i>Min</i>	160

*Code for designation of steels: Part 1 Based on letter symbols (*first revision*).

†Suffix BT indicates Boron Treated Steel.

6. INCLUSIONS

6.1 The permissible slag inclusions under group A, B, C, and D for thick and thin series shall not exceed 2 when measured in accordance with IS : 4163-1982†.

7. MAGNETIC PARTICLE TEST

7.1 Recommended Stock Removal on Diameter for Hot Rolled Bars

*Method for Brinell hardness test for metallic materials (*second revision*).

†Method for determination of inclusion content in steel by microscopic method (*first revision*).

<i>Bar Size</i> (mm)	<i>Minimum Stock Removal from the Surface</i> (mm)
Up to 12 inclusive	0.75
13 to 19 "	1.25
20 to 25 "	2.00
26 to 39 "	2.50
40 to 49 "	3.00
50 to 63 "	3.75
64 to 89 "	4.00
90 to 114 "	5.00
115 to 129 "	6.00
130 to 150 "	10.00

7.2 The turned bars shall be tested for surface and sub surface defects at a magnetising current of approximately 600A ac for every 25 mm of diameter. Prorate increase in amperage above 25 mm and the acceptance standard shall be mutually agreed to.

8. GRAIN SIZE

8.1 When measured in accordance with IS : 2853-1964*, the grain size shall be fine grain preferably 5-8.

9. HARDENABILITY

9.1 The hardenability test shall be conducted in accordance with IS : 3848-1981†. The hardenability requirements shall be as agreed to between the user and the manufacturer.

10. SURFACE DEFECTS

10.1 The depth of crack shall not exceed 0.05 mm for bright peeled bars up to 25 mm diameter and 0.10 mm for bars above 25 mm diameter. The surface of the bars shall be free from seam, scales, rust, folds and other irregularities.

11. TOLERANCES

11.1 The tolerance on diameter shall be +0 and -0.1 mm.

11.1.1 For centreless ground bars tolerance shall be $\begin{matrix} +0.13 \\ -0.00 \end{matrix}$

*Method of determining austenitic grain size of steel.

†End quench test for hardenability of steel (*first revision*).

11.2 The bright peeled bars shall be supplied in length of 3 to 5 metres with 10 percent short down to 1 metre. The deviation from straightness shall not exceed 2 mm per metre length.

12. TEST CERTIFICATE

12.1 Steel suppliers test certificate shall accompany each cast/consignment covering:

- a) Chemical composition,
- b) Mechanical properties,
- c) Grain size, and
- d) Inclusion rating.

13. PACKING AND MARKING

13.1 The bright bar steel shall be treated with suitable rust preventives and packed in bundles suitably wrapped. A metal tag shall be attached to each wooden case giving the following information:

- a) Name and trade-mark of the manufacturer,
- b) Steel grade and size, and
- c) The cast number of any other identification mark by which the steel can be traced to the cast and heat treatment batch from which it was made.

13.1.1 The colour scheme specified in IS : 2049-1978* may be adopted to indicate the grade of the material.

13.2 The material may also be marked with the Standard Mark.

NOTE — The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

*Colour code for the identification of wrought steels for general engineering purposes (*first revision*).